

Richard Emmerson, INDETEC International

Yes, first I'd like to comment about what level of verification would we expect whether we're comparing to reality or anything else. I think it was Louis Carroll once put forth that the best map would have a one-to-one scale. And, of course, if we had such a map, we wouldn't need one. That's the nature of proxy models is they are not going to replicate any particular circumstance. They're not going to capture the ski resort at the top of the mountain, etc. But I do think there is a reasonable — and it's really a judgment matter — a reasonable level of comparison and criteria that have to be met with respect to validation. That comes up in Question 4.

The second point goes to the variety of costs, marginal costs, etc. and that is that one model can't do it all. A model designed to provide universal service funding will look at an integrated network, not the cost of selling that network in bits and parts. Finally, there are differences in these models. This goes to the chart that is raised up there, and the differences are very evident in that chart and the chart that was filed with the BCPM. While the models may produce the same aggregate number, they do not produce the same numbers state by state. They do not behave the same way as one changes input values and then observes the changes in output values. And I think that needs to be looked at very closely in selecting among these models. Thank you.

David Krech, FCC

Alright, Vin, you get to defend your chart here now.

Vincent Callahan, NYNEX

The purpose of today's presentation for me is not to defend the chart, just to indicate the differences between the two models and what I view as some disparities between the two. These are file models. The \$600 million difference, in my view, between the two models is probably one of line counts and input differences. I did not vary any inputs, this is strictly what's on the record and all I'm demonstrating is the difference and the impact this will have on individual ratepayers, and individual states.

David Krech, FCC

Jeff.

Jeffery H. Rohlf, Strategic Policy Research

I think it's useful to draw a comparison here between the standards of scientific discourse and what we're doing here. To publish an article in a scientific journal, it's not enough to just show that your model has an elegant structure that is internally self-consistent. To have a publishable article, what you need to do is demonstrate that it explains some phenomena in the real world better than the pre-existing models. And it seems

to me, that standard which is second nature in science, is not a standard that we've used up to date in terms of validating these cost models. The cost models as they exist now are just simply mental constructs that really haven't been — nobody's demanded that they predict something in the real world. And that's what validation is all about. That's the missing link, I think, so far in interconnection pricing. And as I'll get to in my next answer, I think that a good way to do that, to attempt that linkage to the real world, is by reconciling top-down and bottom-up cost models.

David Krech, FCC

Thank you. Trevor.

Trevor Roycroft, Ohio University

It seems that if you analyze the overall results of the models, that the models perform fairly well when it comes to the RBOCs and when you get to the smaller companies, then there are concerns raised about the relationship to the embedded costs. And in looking at this overall process, the small companies are going to be exempted for some period and then transitioned in. And the question that comes to my mind is, what's going to happen when this transition begins and it becomes clear that these models may not be working as they have in the previous three years for the larger companies.

David Krech, FCC

Okay. Joel.

Joel B. Shifman, Maine Public Utilities Commission

I think that the deficiencies in the models are so extreme — particularly in both the BCM2 and its successor as well as in the Hatfield and its successor — are so extreme that they're not only misallocating dollars between little companies, but they're misallocating dollars between Tier 1 companies. That Nebraska is getting more money and it doesn't need it. If you look at bottom-up studies, top-down studies, that's low cost to serve territory. Vermont, Maine, West Virginia are high cost to serve territories, no matter which way you look at it. An inherent defect in both models is creating such substantial errors that for big companies, they may be able to live with it. Little companies are going die. You've got to correct the fundamental modeling errors which are the distribution of customers as well as the CBG problem. You've got to correct the structures. I've looked at — you know the structure assumptions uses defaults in the Hatfield Model just don't jive with reality. I went out and actually counted attachers to poles, found out that in rural Maine that there was an average of between 1.7 and 1.8 attachers to aerials and in rural Maine I would not find anyone who was sharing a buried attacher with a buried trench with a telephone company. So, the assumptions were just wrong. And if you use incorrect assumptions and try and model the distribution dollars

based on incorrect assumptions, little companies are going to die vis-a-vis one another, the high-cost companies, and it's very unfair to transfer money to the states based upon models which are inherently defective.

David Krech, FCC

John.

John Schrottenboer, Southwestern Bell Telephone Company

I don't quite know what to say after that, Joel. (Laughter)
I think that there are some big differences that needed to be explained and I think that we need to maybe take a bigger picture of what these models are being used for. I think that to a certain degree the models have become a purpose unto themselves and we forget what they're to be used for or what they're being proposed to be used for. And it's being proposed that models be used in interconnection access reform and now universal service. If the results of these models indicate that only 50% of the cost that an embedded company would have from an embedded base is going to be allowed in these venues, it seems to me we have a serious problem that needs to be considered in some way.

David Krech, FCC

Thank you. Page.

William Page Montgomery, Montgomery Consulting

Well, I think I tend to agree that until people are confident that they have a model that really works and that people are comfortable with, it's probably better to focus just on the universal service application. That's what the statute requires of the Commission and the Joint Board and that does not require the grand unifying theory, if you will, of network costs to be rolled out by May 8 of this year. What the purpose of universal service also I think is a little bit more elastic than trying to apply the same type of models to all of the different policy areas. There's a little bit more room, at least initially, for errors in the models to be detected through actual practice. Although in saying that, I want to say that I do find it difficult to reconcile the idea that in the long run, the most recipients, at least initially, of universal service funding, will be small and rural companies, and yet those are the ones for whom the impact may not be known for a couple of years.

David Krech, FCC

Thank you. Lisa.

Lisa K. Hanselman, GVNW Inc./Management

Okay. First, to address Ben's comment on differentiating the structure from the inputs, and I agree with that and that's why I mention the issue about isolating the embedded base from the physical plant because I think it could get down to the

structural issues. But also on the discrete items, I agree that we could come to closure on those, but what I think is going to happen it's going to drive for the rural companies to maybe, hopefully a different set of inputs overall that are more applicable to our environment. And then to Trevor's comment. Yes, the rural company does have three years in which to make a transition. However, just to bring up a point that was made, I think yesterday, there are some, I think, 100 new potential entrants that may be here before that time that don't have a frozen level to deal with before that time so they may be forced to go on a proxy. So, therefore the models are an issue. Then, just one other thing. In terms of the Hatfield Model itself, there's one set of inputs that really prevented us from doing anything that that's in the expense set. We couldn't run those at all because of the reporting requirements.

David Krech, FCC

Thank you.

Laurits R. Christensen, Christensen Associates, Inc.

Ben Johnson and others have conjectured that the action is in the inputs, that once we get disagreements reconciled on terms of inputs, we're going to have the results of these models very close to each other. My analysis finds that that is true, at least to the extent that you look at statewide averages. Now, ultimately these models aren't going to be used for statewide

averages, or at least that's not what's going to move money around. But certainly that is a place to start in seeing whether these models are converging in a way that's going to be useful to the Commission. What I have found is that currently the models are about \$12 per line apart. That the Hatfield Model gives a figure of about \$12 per line per month on a statewide average basis that's lower than the Benchmark Cost Model. And there's been a lot of discussion yesterday and today about the differences between inputs, and I've been able to do some analysis that quantifies the primary differences in inputs that are driving that \$12 difference. And the most important is this issue of overheads which has been discussed. Whereas the Hatfield has a 10% adder basically on investment, whereas the Benchmark Cost Model has a fixed \$8.30-some cents per line. That accounts for \$5 out of the \$12 difference between the model results on a statewide average basis, almost half of it. The next biggest one is the structure sharing. That accounts for \$4 worth. The fact that the Hatfield Model uses Bell-only data accounts for \$2 worth. And then the cost of money between the Hatfield Model which uses 10.01% and the Benchmark Cost Model which uses 11.25%, that's a dollar. Add those up and you get the \$12 difference that we're currently looking at between these two models.

David Krech, FCC

Okay, thank you. Let's move on to the second question which is: How can an econometric studies be used to validate

engineering economic cost models such as the Hatfield Model, BCPM and the Telecom Economic Cost Model? What problems do econometric models encounter that limit their ability to validate engineering models? Let's start with Rick on this one.

Richard Emmerson, INDETEC International

Okay, thank you. First of all I think Bill Taylor yesterday summarized econometrics and its application very well, but I'd like to point something out that econometrics doesn't mean you have to use and know linear algebra. Econometrics simply means measurement within the context of economics. Picking a single data point as an input to an economic model is econometrics. Averaging two data points is econometrics. What we're really talking about is acquiring data from the real world that increases our level of comfort with any of these models. Therefore, I have to say econometrics is extremely useful.

I think it's generally accepted that econometrics or econometric models do not substitute for these cost proxy or engineering models or we'd be discussing those here today. We don't have the data. It's too complex. We can use econometrics to assess the input values, the input prices, to try to help validate whether or not the quantities of resources required to operate a telephone network are reasonable. We can use econometrics to determine whether the relative costs across various states, CBGs, etc., are reasonable and whether those, at least comport to some extent with reality. I would urge

everyone, therefore, to in some sense support econometric validation of these models wherever we can compare the results of the models to real world phenomena. Thank you.

David Krech, FCC

Okay, Dan.

Daniel Kelley, Hatfield Associates

I think I want to agree partially with Dr. Emmerson. You know, as an analyst you never want to throw out information or throw out data. And there are places where you can use a statistical or econometrical analysis to help you build a value forwarding-looking engineering economic cost model. Having said that, though, I'm very skeptical of the replacement models I've seen or the econometric models I've seen to estimate TSLRIC and TELRIC because, when you get into the real world, there are really two real worlds. There's the real world of history, which is captured by embedded data, and there's the real world of what an efficient new entrant would do if he were constructing a network to provide telephone service today. And as our models show, you're going to get two very different answers. And what we've been asked to do in our model is forward-looking costs. What would an efficient new entrant do? Then the question becomes how valid are econometrics based on embedded data going to be in helping you answer that question? I think the answer is, not very helpful. The embedded data that you use in

econometric analysis measures an array, you know, the results from providing an array of existing services with existing embedded technology. It doesn't measure the forward-looking quantities and costs that need to be measured.

I've looked at Jeff's model. I'm not an econometrician. I've looked very quickly at it and I think there are a number of specific problems with it that we could get into in detail, and an econometrician could get into in even more detail, but I think there are biases in the way that average cost is dependent on density. Instead of using density as an explanatory variable, there's a transformation done in there which I think presents a bias. There's really no economic model that serves as a basis for the econometrics. What you want to do in economic cost modeling is figure out how to measure the envelope curve of the cost function and I don't think the model does that. It picks up averages.

David Krech, FCC

Thank you. Ben.

Ben Johnson, Ben Johnson Associates

Yes, I am skeptical about, from a regulatory point of view, trying to use the esoteric world of econometric modeling in the high-level sense to test these models, although certainly if someone wants to pursue that I have no objection to it, I'm just suggesting that you'll find there's as many fights about the

functional forms of the statistics and like as there are about these computer models that we're dealing with here. A different type of econometrics that Rick Emmerson was suggesting, I'm all for, and something we've actually done a little bit of. You've got a data set that's just been provided by Southwestern Bell. They've told us the number of loops by wire centers. We've looked at similar data sets provided in discovery in other states, unfortunately, they were cloaked in secrecy so they weren't on the public record. But, we were able to do some fairly simple fitting of that data against the loop counts coming out of BCM2 and found a pretty good fit. But, it certainly highlighted the fact that it was not a perfect fit. We got about 90% correlation as I recall. And one of the things you could then do, but we didn't have the time to fully pursue, is to try to find what is causing the problems. First, you look for outliers and actually focus on those wire centers and try to understand is there something wrong with the model? Is this an example of that mapping problem?

Secondly, if there's another fundamental bias still remaining, you'd try to find an explanatory variable that would tell you where that is, such as the problem of empty spaces or whatever. And maybe there's a variable that would capture that which would allow you to automatically refine your data. The problem with that particular approach is getting more data. We've got some data from Southwestern Bell. It would be great if we had even a sample of loop lengths for those wire centers, and I would urge Southwestern Bell if they have some studies along

those lines to please submit them to us and make them available. And I know many other companies have loop counts and have loop lengths or at least samples of loop lengths or estimates of loop lengths, that would be wonderful to be using. They're cloaked in secrecy for no good reason. In my opinion, the regulators should require that kind of information to be disclosed. It's essentially — and how many phones are out there? You go look in a phone book, you can get pretty close. It's just not that big a competitive secret. So, I think that sort of testing is worthwhile and can be pursued.

David Krech, FCC

All right, thank you. Dr. Christensen.

Laurits R. Christensen, Christensen Associates, Inc.

Yes, I'd like to extend the thoughts put forward here by Rick Emmerson and Ben Johnson. In that vein I would like to suggest that it's not a matter of simply econometrics not being useful because it can't look at the envelope as readily as it looks at averages. We have before us quite a few issues to be solved that really can — if averages and simple econometric models are used creatively — can help us close the gap between these models and get where we need to go. That the numbers I just gave a few minutes ago indicating there was \$12 difference between the models in outputs, \$9 of which are accounted by two factors where real world data can really provide the answers.

The one is structure sharing. You've all heard the discussion, I don't have to rehash it, is there sharing isn't there, well, presumably there's some data out there that can be brought to bear on this issue, and should be brought to bear on the issue quickly. The other one, in terms of overhead, you know, does overhead vary with level of investment? As Bill Taylor described yesterday, there's pretty straightforward ways to take a look at that and bring some data to bear on the issue. And, so, this question of is it just a matter of getting the inputs right? And, in a sense, if we can do some of the sensible kind of analysis, that will get the inputs right, because short of that, it's just going to be a matter of what's right is in the eye of the beholder, and what one person thinks is right, the other person is not going to think right, and we're not going to be able to narrow the debate and get closure on these issues, which I think is terribly important.

David Krech, FCC

Thank you. Lisa.

Lisa K. Hanselman, GVNW Inc./Management

My approach on this question comes out — well, econometrics to me has to do with causal relationships, the way variables move together. And, I think in relation to the models, there is an area that we haven't really discussed too much so far and that's the area of fill factors. And I'd just like to pose that there

are many variables that maybe could be looked at to see how we could modify the way those fill factors are used in the models. And some of those factors are, and we've mentioned them briefly: Growth rates that vary from one area to another, customer demand patterns that vary from one area to another. Line types are treated differently for business, for residence, for public, both in plant and technical and fill characteristics. Sharing, and I'm not talking so much about sharing in trenches and poles, but I'm also talking about sharing that results from co-location because we get equipment in the buildings now that are shared or that we don't fully utilize. Density characteristics also impact fill factors. And one that's kind of close to my heart is network reliability also has an impact, and that's because in order to protect certain critical areas of the network, certain critical circuit types, we intentionally underutilized portions of the network in order to maintain survivability.

David Krech, FCC

Thank you. Page.

William Page Montgomery, Montgomery Consulting

I think that we're talking about econometrics here at two levels. One is a broader level that's accessible in the sense that there is a way to obtain data from a sample based on how structures are shared from the real world. The other level, and unfortunately most of the changes, most of the big changes that

Dr. Christensen has identified and that have been identified between, let's say, the Hatfield Model and more than one proprietary ILEC model, most of the biggest differences fall into that category, not extended econometric modeling exercises, but simple data gathering and data refinement. When you talk about the more detailed level of econometric analysis, however, the problem we'll run into is the problem that hasn't been mentioned here so far in enough detail, in my opinion. And that is you very quickly get into data that is considered confidential or proprietary and requires a lot of non-disclosure agreements. I think that is antithetical to trying to develop a competitive industry that operates on an open set of information.

And in some respects, I think even some of the things that we've identified here in the last couple of days, like switch manufacturer's discounting practices. I imagine that everybody in the industry, either in the industry or a consultant to the industry, has a very good idea what those discounts are. It may be only the regulators who don't have access to that information. (Laughter) And, in some respects it is a trivial thing, because as many people as there are in the industry, as many vendors as there are, people coming into the industry, it's come to the point of being common knowledge to people, I think, that there are substantial vendor discounts, very substantial from list prices, it's just that we can't communicate to one another what those discounts are. That's the problem with econometric analysis at the more detailed level, is it depends upon confidential information.

David Krech, FCC

Thank you. John.

John Schrotenboer, Southwestern Bell Telephone Company

First of all, I'm not an economist, so I had trouble with this question a little bit, but I'll try and answer the question. I thank Dr. Emmerson for putting it in a context that I can understand of using some data points and averaging things, I can relate to that. To whatever extent we can do things like that with an existing set of data, whether it's ARMIS data or other data that the companies are willing to provide, I think that that should be done in terms of evaluating these models at whatever level we can, whether it's something taking the overhead factors that Dr. Christensen mentioned and trying to relate those from what is embedded in the companies, what's a historical relationship from the companies to what might be used in the models, or to whatever other extent we can from the embedded data. There is a lot of data out there that is available. I don't know how much of it that can be used for purposes of testing the models and these various things, but I think that we need to look at what we want to compare, see if that data is available. I will grant you that there are a lot of cases where data is proprietary and confidential and has been used that way in State Commission proceedings. That's not my choosing and it's not my call to make, but I think that that — to whatever extent we can identify a set of data that we would want to use that

might be limited in a nature to provide some light on this whole topic of models and how the data is used and how it relates, I think would be helpful. But the first step is to identify those items of data that we want to look at.

David Krech, FCC

Thank you. Joel.

Joel B. Shifman, Maine Public Utilities Commission

Yes, using sort of the macro definition of "econometrics" that Rick Emmerson provided can lead to some very valuable results of identifying, particularly some of the deficiencies in the models and I cite two examples. One example where one of the FCC staff people identified the fact that the rank ordering of states using the models and the rank ordering using actual data were not the same, and that certain states placed at different places in the rank ordering. Looking at that rank ordering, I then, using that as sort of comparison, econometric analysis in a macro sense, I then sought to explain that phenomena and actually realized that there were two major problems that yielded that, the distribution of customers throughout the CBG or the study area problems yielded that result. The difference is not only in where customers are distributed, but where they were distributed out, not only on the roads, but whether they were distributed off the roads, as well as the lack of using a variable that related to weather. And a lot the states that were in the wrong order

were areas where there were hurricanes. And I had remembered on an 1988-1986 Joint Board I was able to identify from ARMIS data Hurricane Hugo. Whenever a hurricane went through, I could just look at the ARMIS data and see the hurricane. And I actually used independent company's O&M data from the 1982-1986 data request that went back and adjusted the numbers in the rank ordering pick. In a macro basis the rank ordering came much closer to reality. Another example of a macro analysis that could be done was the NECA numbers. That NECA came up with a comparison of companies, model results as well as the embedded results. If you look at the ratios between the numbers, some were very far apart, and tried to cluster them as a function of ratios and looked at which companies clustered together and which companies clustered far apart, and then tried to look to see if there was any homogeneity between those companies which clustered together and those that clustered far apart, I identified the fact that the models were way overstating cost in the Plains, in the Midwestern states where customers are clustered in towns, and they were way understating costs in Vermont, West Virginia and the Northeast. So, I basically, by looking at this macro data, I identify which areas the models were not working in and then I tried to use those to identify what pieces of the models were not working to fix the models to take care of these problems.

David Krech, FCC

Thank you, Joel. Vin.

Vincent Callahan, NYNEX

Just a couple of thoughts. I agree with most of the panelists about the concerns about handling these econometric models with some kind of reality. I guess I'm concerned about the impact that econometrics has on financial and engineering network abilities. Even if an elephant inadvertently steps on an ant, the ant doesn't feel much better because it was inadvertent. On a second note, though, I just want to mention that in this whole process and procedure which I've been involved in since it began about two and a half years ago, this has been a very, very difficult proceeding, not because the model builders meant it that way, but just because it was, because you needed special computers, because you needed additional hardware, because you need additional software. There are many, many people, both industry participants and state regulators, that didn't have, perhaps the human or financial resources to fully participate. Something that's this critical to the industry needs full participation. Thank you.

David Krech, FCC

Jeff.

Jeffery H. Rohlf, Strategic Policy Research

SPR estimated an econometric top-down cost model last Fall. Our estimate was that the forward-looking incremental costs of loops is about \$25 a month, \$11 higher than what the Hatfield

estimate was at that time. Our estimate of switching costs is almost three times as much as in the Hatfield Cost Model. The model that we estimated is estimated over 96 study areas for two years, and the goal in the econometric model is to estimate parameters so as best to explain cost differences among the 96 study areas and across the two years. And the model does an excellent job of doing that according to standard statistical measures. That is, if one company is here, another company is here and they are otherwise alike, but one company has more loops, the cost that you'll observe for this company will be approximately \$25 a loop more per month than the other company. So this is a model which is tied to real world data, it reflects real world experience and it's, I think, a very useful tool in terms of setting interconnection prices. And the way to proceed, I think, in using such a model is to perform a reconciliation process. That is, to the extent that this \$25 reflects what's happening in the real world today and somebody else says, "no, it's 15, it's 10," that they should be required to explain what real world evidence can they cite that it really is 15, that it really is 10, that it's that much less than what's been observed in terms of actual experience.

This procedure was adopted by OffTel. They went to a lengthy process of reconciling top-down and bottom-up estimates. The result of that was that they got estimates that were significantly higher than the bottom-up cost estimates. The OffTel process consisted of two steps. First, to recast the models under a consistent set of assumptions, that's what Lau was

talking about. And the second step is to try to understand remaining differences and see what insights are revealed in looking at the remaining cost differences.

David Krech, FCC

All right, thank you. Trevor.

Trevor Roycroft, Ohio University

I would agree with the views expressed regarding the use of statistics to analyze what I would categorize as good data. The problem with econometrics that I see is that once you don't have good data, then econometrics starts to become too complicated for most people to understand and I think that we want to keep this process as open as possible, and not exclude people who have otherwise valid insights on the cost of providing universal service simply because they don't understand the complicated econometric mathematics behind a particular study. Part of the problems that can arise from econometric studies is that the data sets may not coincide with the problem that we're trying to solve here. Some econometric studies are difficult to disaggregate and other econometric studies don't provide the same type of cost estimates that are being discussed by the Joint Board at this point. And, I think that's it.

David Krech, FCC

Okay, we'll move on to the rebuttals then. And we start with Rick.

Richard Emmerson, INDETEC International

Well, I don't feel compelled to rebut anything I've heard, but I do feel compelled to use my minute so — (laughter). First of all, I think it's important — I think we all agree if we set aside the notion that using the best data we have in the best available way is not, quote, "atrocious" econometrics. That it can be useful and is useful and should be used. But, I think I'd like to put this in a broader context. I'm reminded that the very largest econometric models that existed in the world years ago ran on the very largest computers in world and they were constructed and run by the Soviet Union in order to try to replicate that market economy which we operate in here today. Whether it be proxy models, econometric models or anything else, I think we should not lose sight of the fact that none of these are substitutes for the marketplace and letting the marketplace do its job. We're trying to manage a transition, we're trying to pick appropriate values for starting points from which there should be a deal of flexibility for prices, universal service funding mechanisms and other things to move as market conditions develop. Thank you.

David Krech, FCC

Thank you. It's Dan's turn now.

Daniel Kelley, Hatfield Associates

Thank you. Just a few comments. And I, too, agreed with a lot of what was said. It would be useful to have a database that shows actual structure sharing across CBGs, across telephone companies or across anything else, but there's a danger here I think we ought to all be aware of, and that is the models are designed to estimate forward-looking economic costs. When you look at a database that contains existing structure sharing, you're again looking at an embedded practice, embedded practice in an industry dominated by rate of return regulated firms like electric, utilities and telephone companies. We after all are sitting here today in universal service session, but other economists and analysts at this Commission are spending a lot of time worrying about TELRIC and local competition. And we have had years and years and years of controversy where local telephone companies have been denying access to potential competitors to their poles, ducts, and rights of way. So what you're measuring in the embedded data set isn't what you'd want to put in the efficient forward-looking cost measure that you're trying to develop.

David Krech, FCC

Thank you. Ben.

Ben Johnson, Ben Johnson Associates

I'm going to use my minute to reinforce the point that Lisa was making, something that I was talking about quite a bit yesterday and on Monday. I think it's great that we're all working very hard to roll this out by a statutory deadline and I think we're making tremendous progress. But in that process, let's not lose sight of the fact that real people and real dollars are going to be affected. So, we really need to be emphasizing the importance of gathering more data and opening up these models and making sure that the people and the States that are potentially affected have an adequate opportunity to comment and to point out those types of differences. I'm very sensitive to that. I've work for everything from the Alaska Public Service Commission, we've done a lot of work for them. In this particular instance we've been working for New Jersey. Those are the polar extremes in terms of geography. New Jersey tends to pay in, Alaska needs to pull out. But both of those clients care about the same thing, which is to do it right. And I think there's a common theme there, but there have been problems. We haven't had as much data, for example, on loop counts by census block — excuse me, by wire center as we know is readily available. If we could get more of that data, it would rapidly